Pacific Northwest VHF Society

www.pnwvhfs.org

W7VHF / K7VHF

Representing Washington, Oregon, Idaho and British Columbia

Making radio work when the going gets tough

Lynn Burlingame

N7CFO

N7CFO Bio

- Ham for 25+ years
- Active in VHF/UHF activities
- I come from a ham family
- Co-founder of the PNWVHFS

Target Audience for this presentation

- New or intermediate ham
- Those without a license

This bibliography from this presentation is available at

www.n7cfo.com

(Go to “Miscellaneous Stuff”)

I will talk about VHF and HF operating techniques that will enhance your ability to make contacts under suboptimal conditions.

Appliance Operators and Hams

Appliance Operators

- Firefighters
- Police
- Military
- Emergency organizations

Appliance Operators - professionals

- Non technical operators
- The system must work the first time - every time
- Simple to work while under stress
- Limited complexity
- Minimal training needed

Appliance Operators - Amateurs

- Obtained an amateur radio license to support another interest
- Likely took a weekend course aimed at meeting license requirements
- The course provided little hands-on training

Hams

- Are appliance operators too!
- Are Geeks
- Have enormous junk boxes
- Have equally geekish friends….

Hams…..

- Are into radio for the sake of fooling with radio
- Make some of their own stuff
- Love to brag about the neat stuff they have made
- Fix their own stuff – or at least destroy it while trying

Weak Signal VHF/UHF Operations

Weak Signal VHF/UHF Operations

- From high ground in W/WA you can easily work into Oregon on 2m, 220 and 432 SSB or CW
- Paths over the Cascades occur frequently
- Paths can make use of mountains as reflectors

Making radio work when the going gets tough

- Weak signal modes are typically SSB and CW
- These modes allow contacts at much greater distances than FM
- Weak signal operating techniques can be applied to FM operations

Operating Modes - SSB

- Avoids the FM “Capture Effect”
- Has a nearly 6:1 signal-to-noise improvement over FM under less-than-full-quieting conditions just due to bandwidth alone (15 kHz versus 2.4 kHz)

Operating Modes - CW

- Has another 5:1 advantage (2.4 kHz vs 500 Hz) that can go higher with narrower filters.
- That's a 30:1 total advantage - about 15 dB
- A decent CW operator can often transmit messages faster, with fewer fills than a phone operator

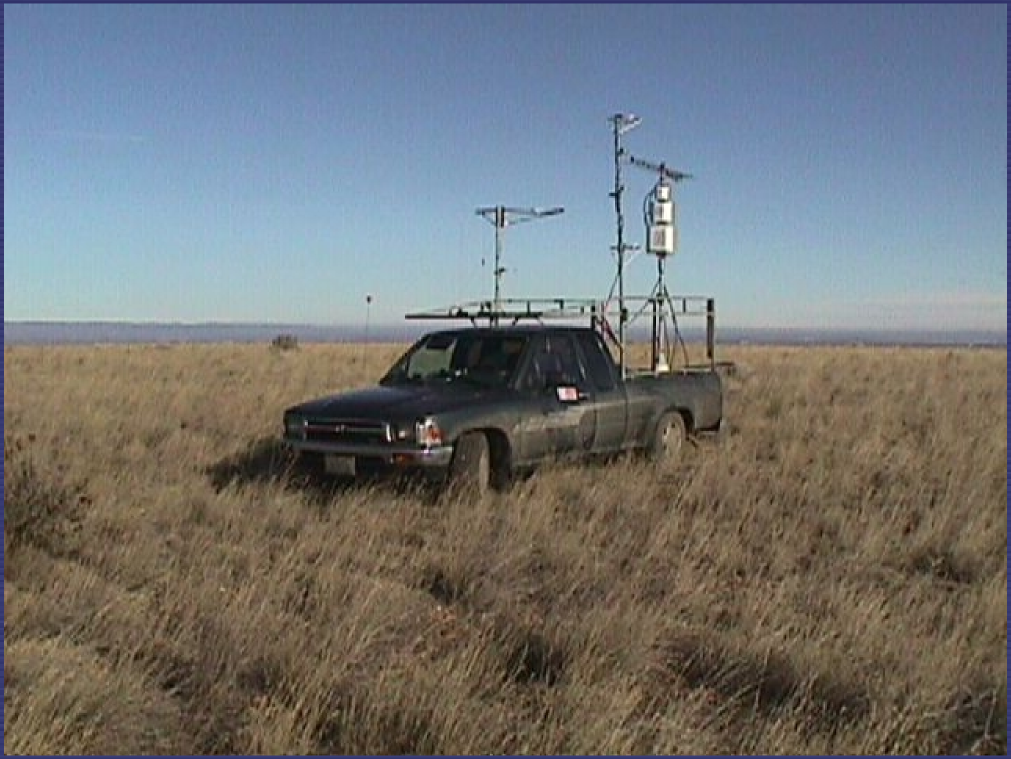
Enhancements

- Aurora
- F2
- Sporadic E
- Ducting

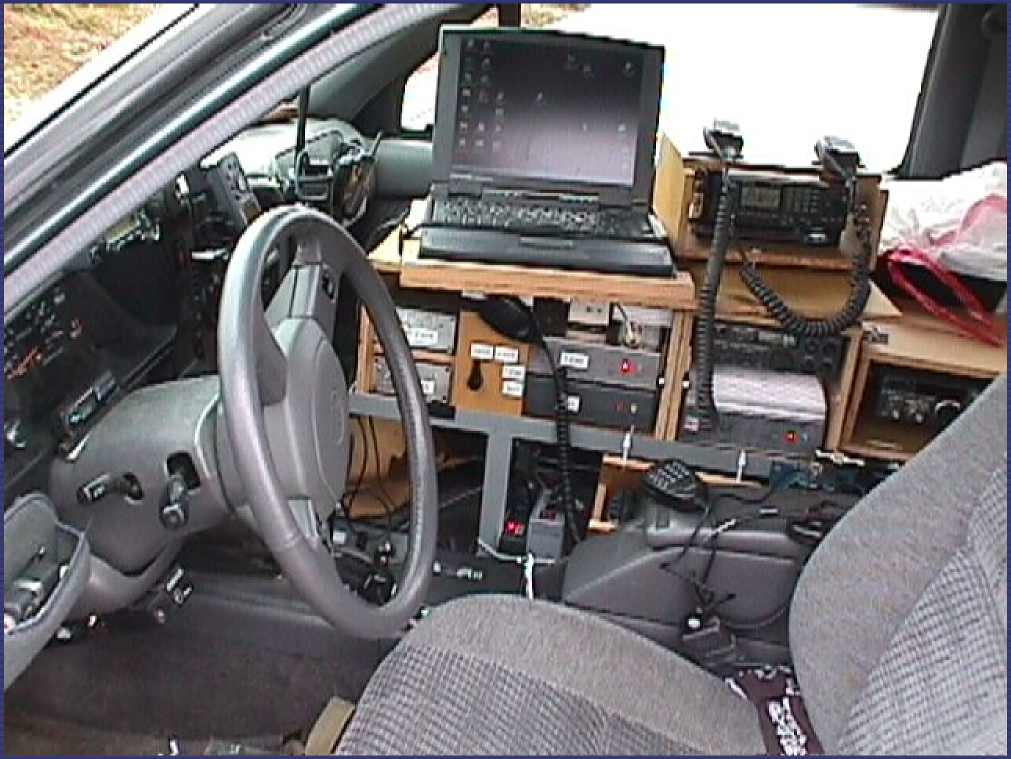
Contests

- Home stations
- Portables
- Rovers
- Three ARRL VHF/UHF contests per year – January, June and September
- Numerous other contests and events

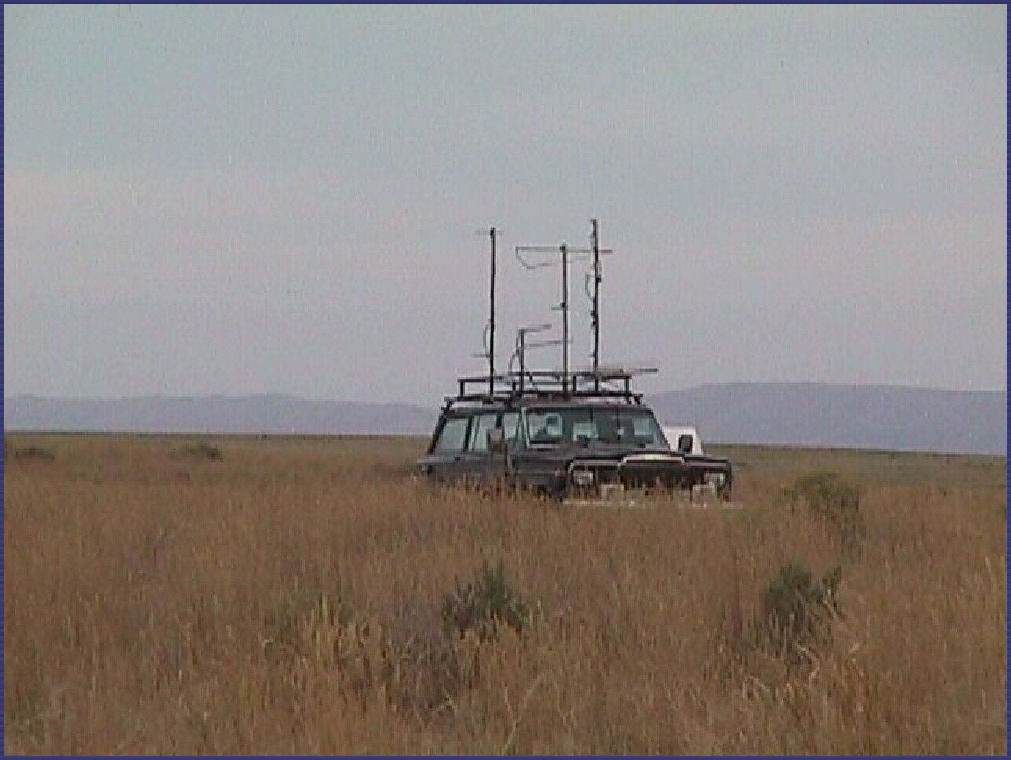
N7CFO/R



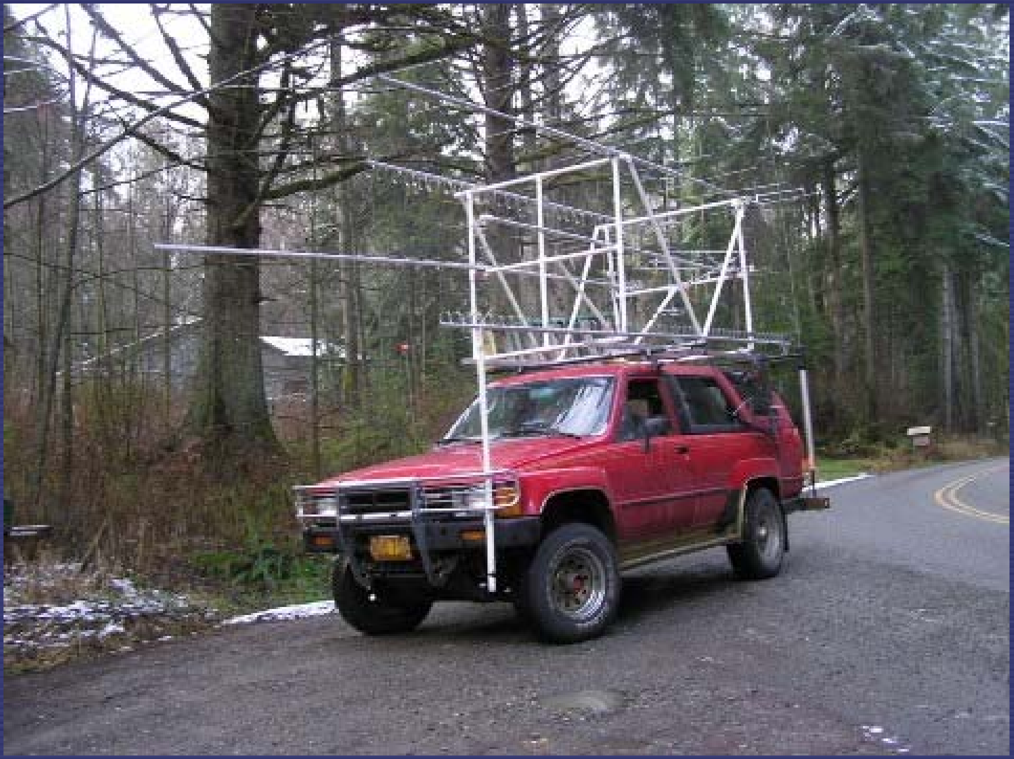
N7CFO/R



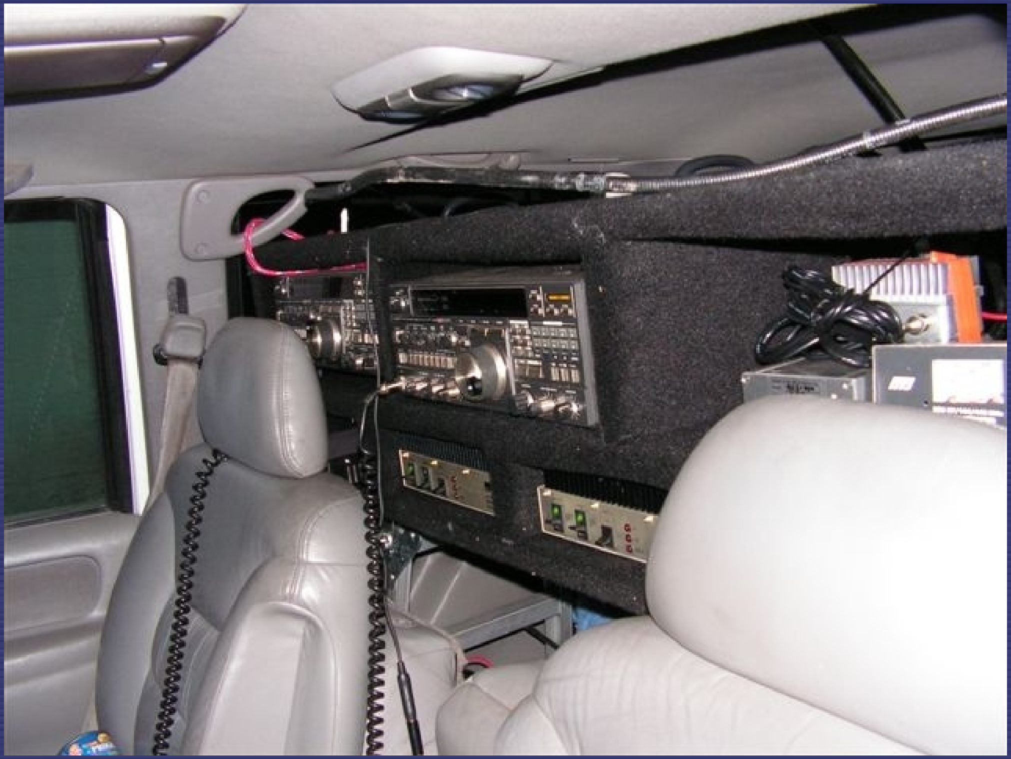
N7MX/R



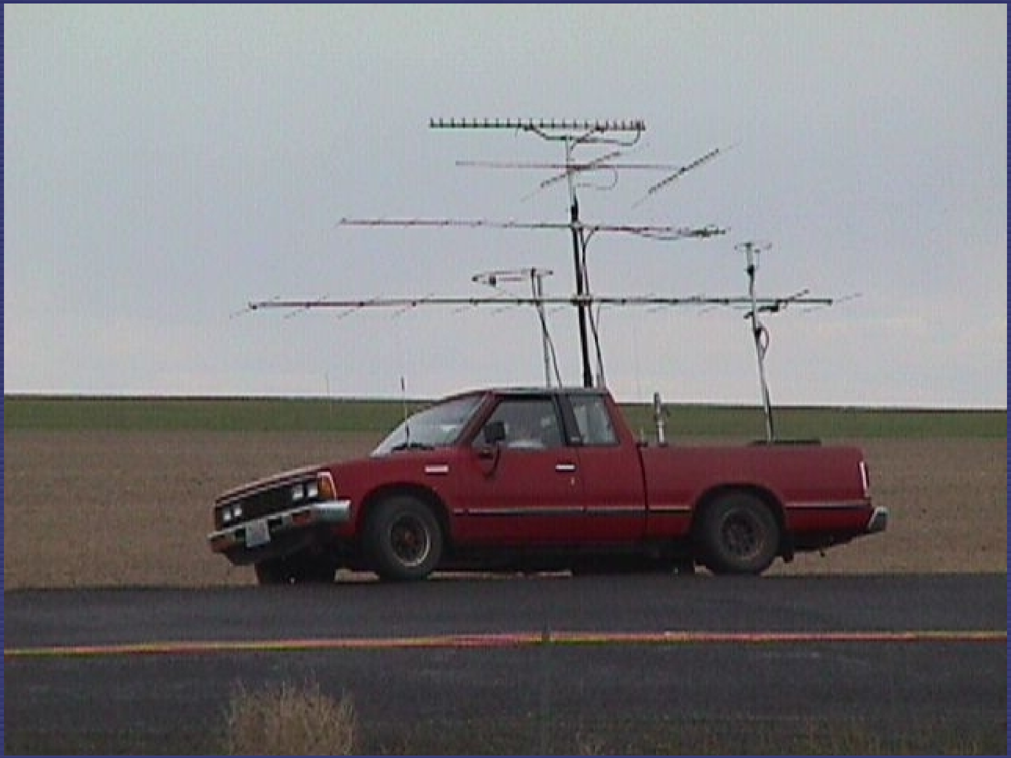
K3UHF/R



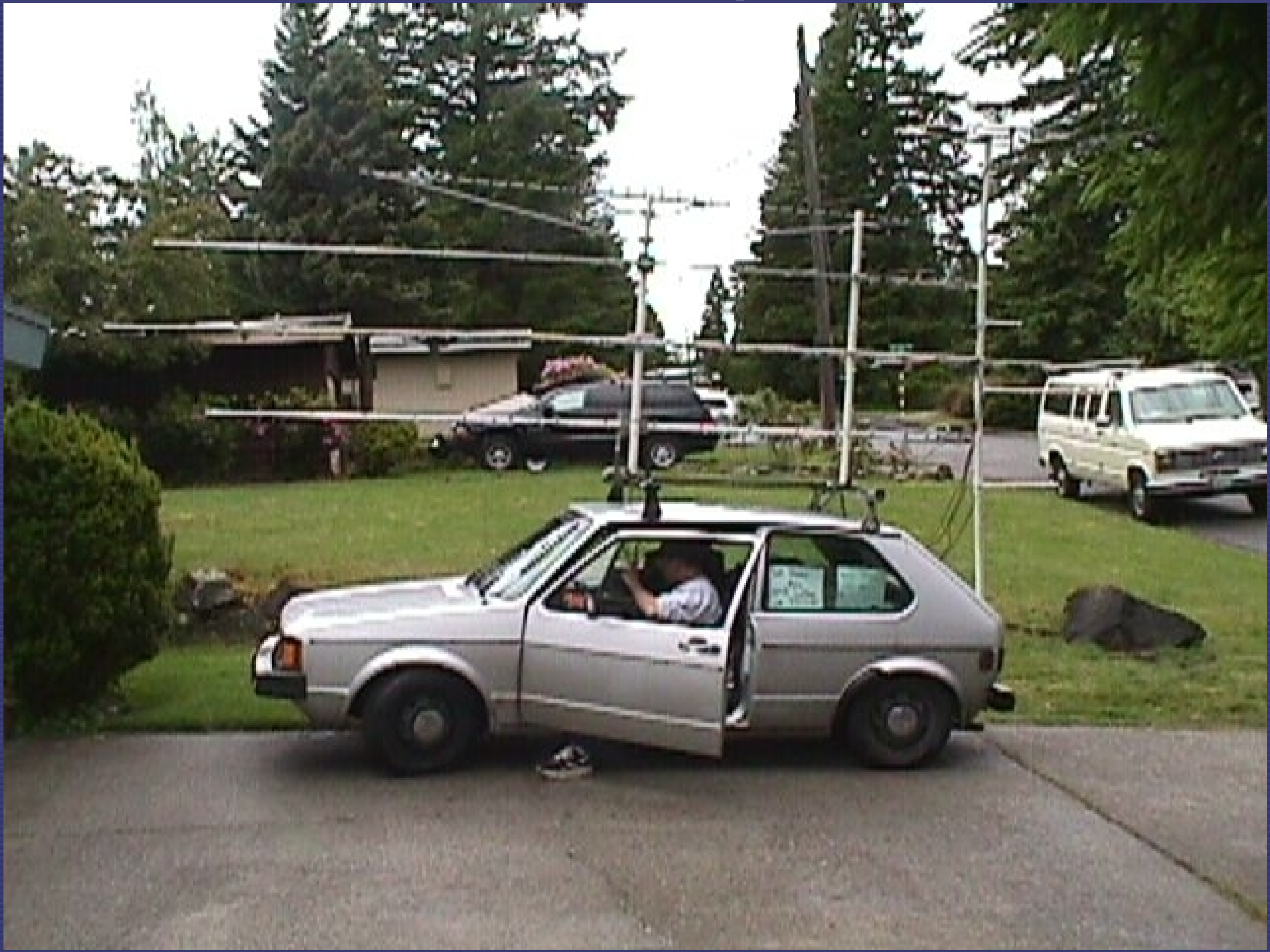
K3UHF/R



WE7X/R



W7IEW/R



Contest Operating

- A good way to test paths and equipment
- Sharpen operating skills
- All bands 6 meters through 10 GHz
- FM frequently used, especially on 220 and 903
- Contest stations often monitor 2 and 432 FM

Operating Frequencies:

50.125	SSB & CW
52.525	FM
144.200	SSB & CW
146.580	FM (PNW STANDARD)
222.100	SSB & CW
223.500	FM
432.100	SSB & CW
446.00	FM
903.100	SSB & CW
927.5	FM
1294.5	FM
1296.1	SSB

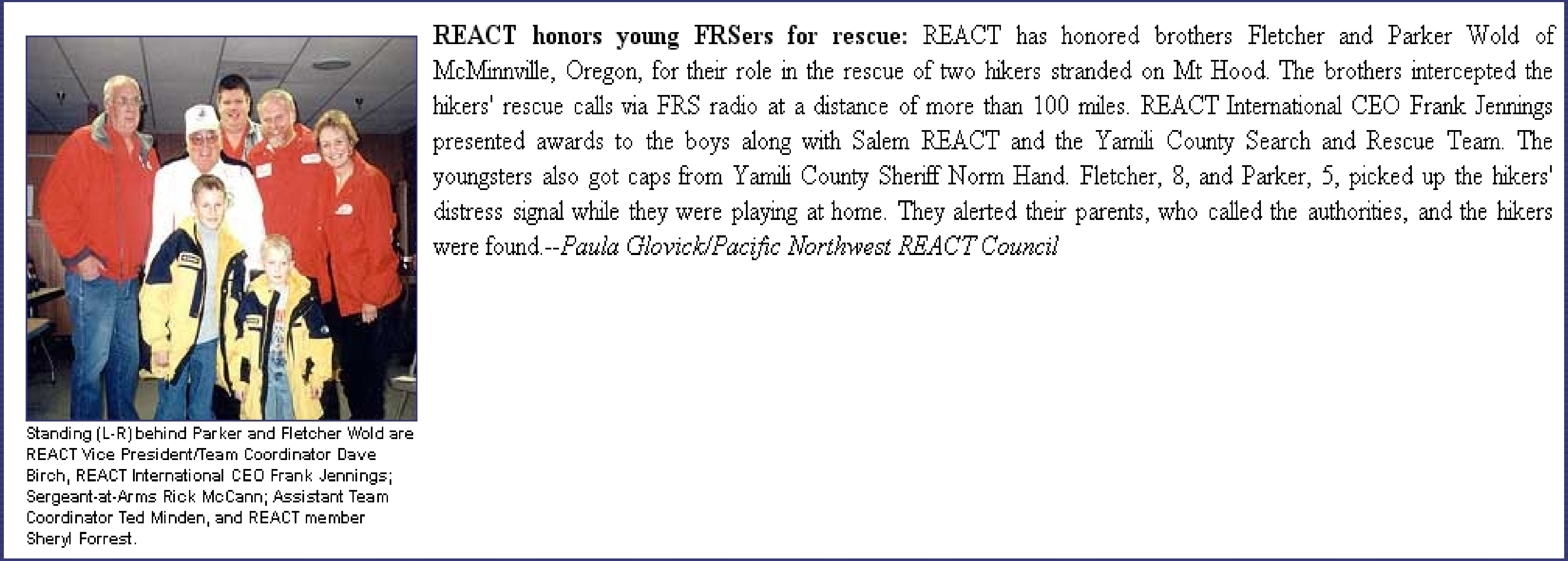
Contest Exchange

- Call
- Grid square [i.e. “CN87”]
- Can work rovers from each new grid

Two Absolutes

- Absolutely everything in amateur radio is a trade-off
- There are no absolutes…..

ARRL WEB In Brief, January 24, 2001



Standing (L-R) behind Parker and Fletcher Wold are REACT Vice President/Team Coordinator Dave Birch, REACT International CEO Frank Jennings; Sergeant-at-Arms Rick McCann; Assistant Team Coordinator Ted Minden, and REACT member Sheryl Forrest.

REACT honors young FRSers for rescue: REACT has honored brothers Fletcher and Parker Wold of McMinnville, Oregon, for their role in the rescue of two hikers stranded on Mt Hood. The brothers intercepted the hikers' rescue calls via FRS radio at a distance of more than 100 miles. REACT International CEO Frank Jennings presented awards to the boys along with Salem REACT and the Yamili County Search and Rescue Team. The youngsters also got caps from Yamili County Sheriff Norm Hand. Fletcher, 8, and Parker, 5, picked up the hikers' distress signal while they were playing at home. They alerted their parents, who called the authorities, and the hikers were found.--*Paula Glovick/Pacific Northwest REACT Council*

Generalities

- Bigger antennas are better
- Higher antennas get better coverage
- Gain antennas work better
- Grouped antennas interfere with each other

More Generalities

Stuff gets in the way of radio signals

  - Metal siding
  - Foil backed insulation
  - Buildings
  - Vehicles
  - Mountains
  - Trees

Yet More Generalities

- Feedlines attenuate signals and should be as short as possible
- If you wander around, sooner or later you will find a “sweet spot”

Amateur radio portable or mobile operations require tradeoffs

- Power vs. battery weight and life
- Antenna gain vs. size
- Beam antennas vs. omnidirectional
- Feedline efficiency vs. size and weight
- Lots of big antennas or staying married…

Antennas

- You can’t do much about a most amateur equipment, but you can do a *lot* about antennas

Antenna gain

- Gain antennas are the easiest and cheapest means of enhancing your signal.
- Gain antennas do not create power – they concentrate it.
- This concentration can work against you by nulling out desirable signals.

Antenna trade-offs

- Size vs. weight
- Size vs. gain
- Size and weight vs. durability

Antenna Polarization

- FM VHF antennas are vertically polarized to match mobile whips on vehicles
- SSB and CW VHF antennas are horizontally polarized
- Horizontal polarization avoids problems with metal masts
- Cross polarization can cost you 20 db!

“Rubber Duck” Antennas – the good news

- They are handy and convenient
- They work well at close range
- They are omnidirectional.
- Can be used conveniently in a vehicle or indoors.

“Rubber Duck” Antennas – the bad news

- They are inefficient
- They radiate equally poorly in most directions
- Multi-band ducks are especially ineffective

More bad news!

- It is difficult to tell if they have failed – when is the last time you tested yours?
- If you are not using a speaker microphone you are transmitting RF energy directly into your eyes!

Rubber Duck Antennas

- The National Institute of Standards and Technology (NIST) allegedly tested Public Safety high band and amateur 2-meter antennas.
- They found that a "rubber duck" has -5db gain compared to a ¼ wave antenna held at shoulder height.

Rubber Duck Antennas

- In terms of effective radiated power (ERP), a 5w HT with rubber duck antenna at shoulder height would actually radiate 1.5 watts
- Placing the HT on your belt attenuates the signal another 20db, reducing ERP to only 15 milliwatts!

“Rubber Duck” Antennas – how to get the most out of them.

- Stand on high ground or object
- Take the radio off your belt
- Get it out of vehicles or structures
- Get into a clear area away from objects or trees

“Rubber Duck” Antennas – how to get the most out of them.

- “Statue of Liberty” pose – use the speaker microphone and hold the radio high
- Move to get clear shot at the target station
- Keep the antenna vertical

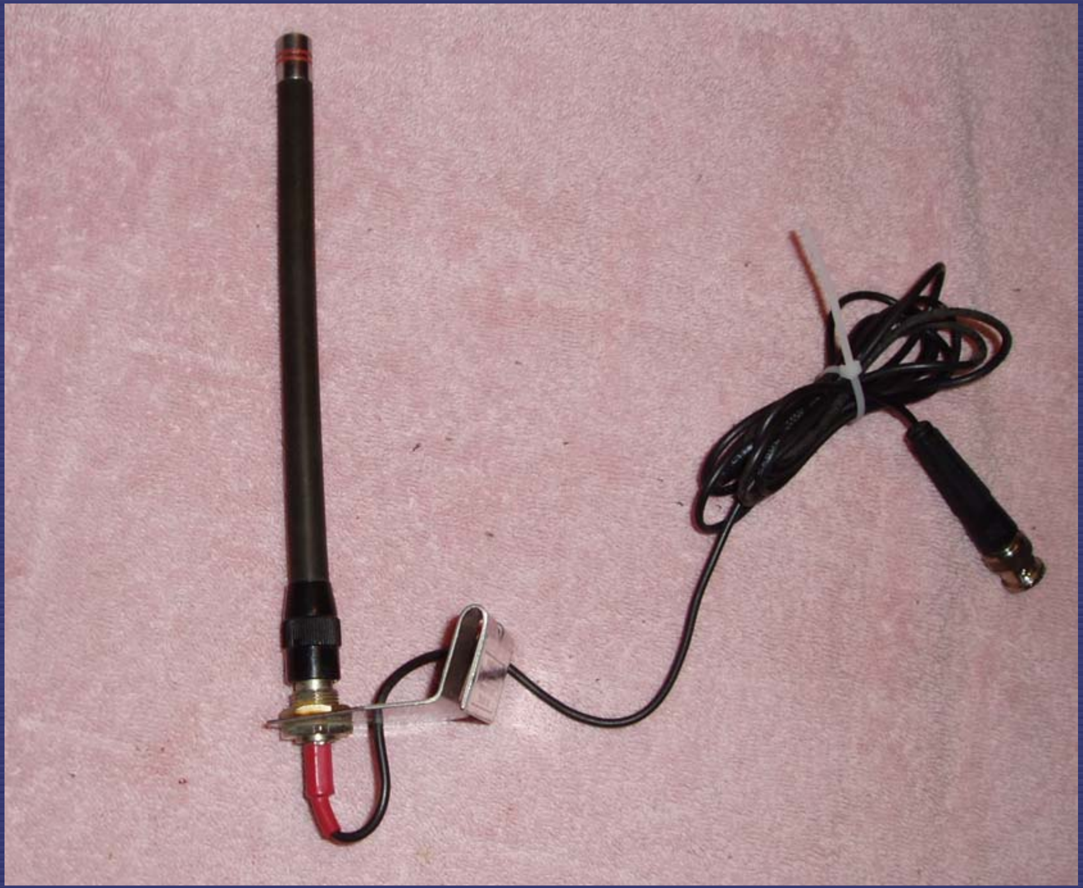
“Rubber Duck” Antennas – how to get the most out of them.

- Know where your target station is, both the direction and the relative altitude
- Program a GPS waypoint for the repeater or base station location and use the “GOTO” function

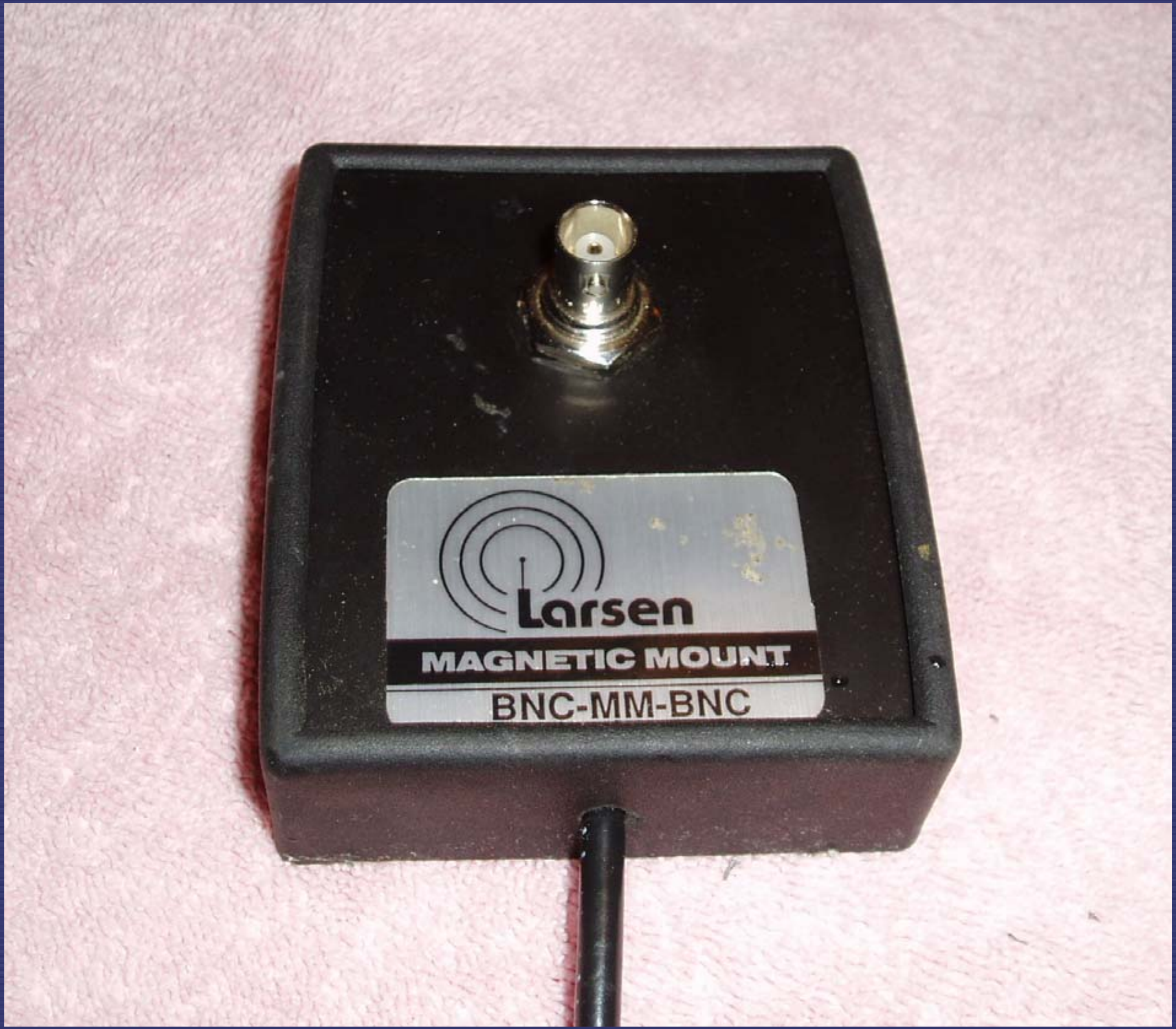
“Rubber Duck” Antennas – alternatives!

- ½ wave telescopic antenna

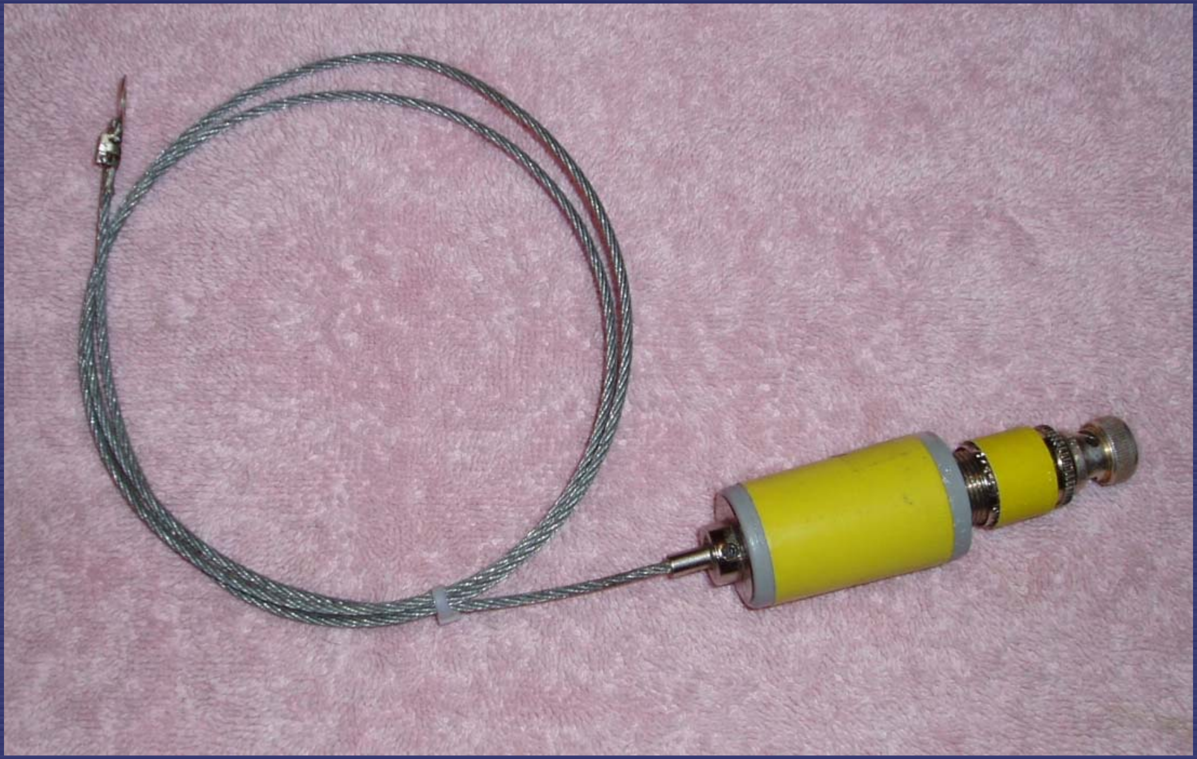
Window mount



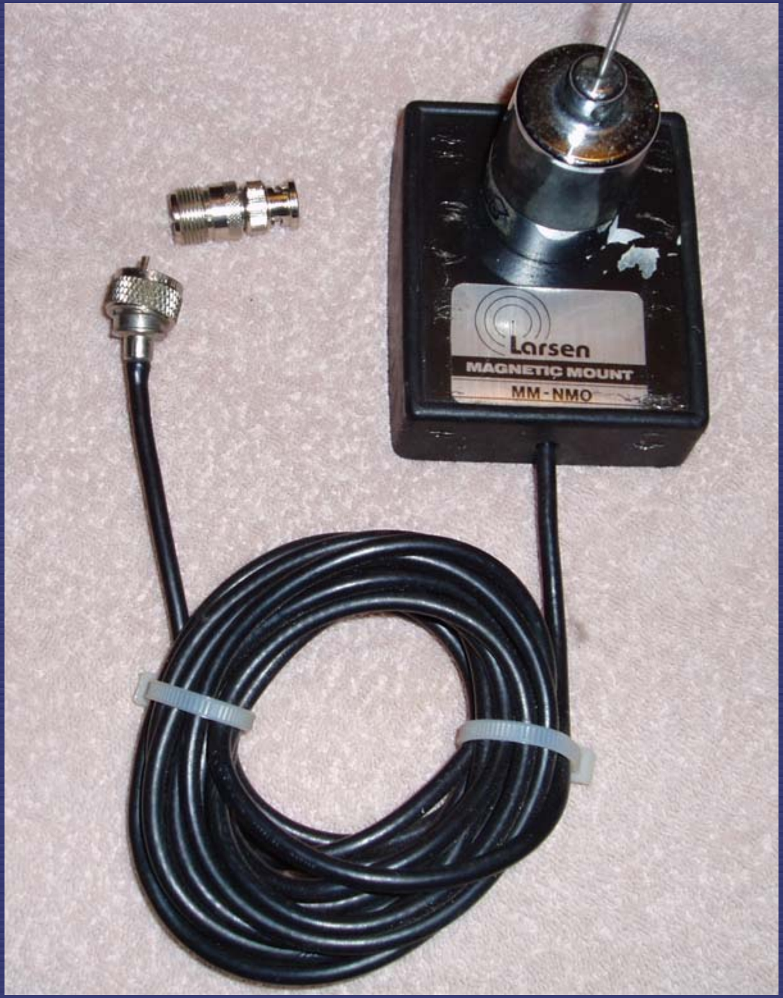
BNC mag mount



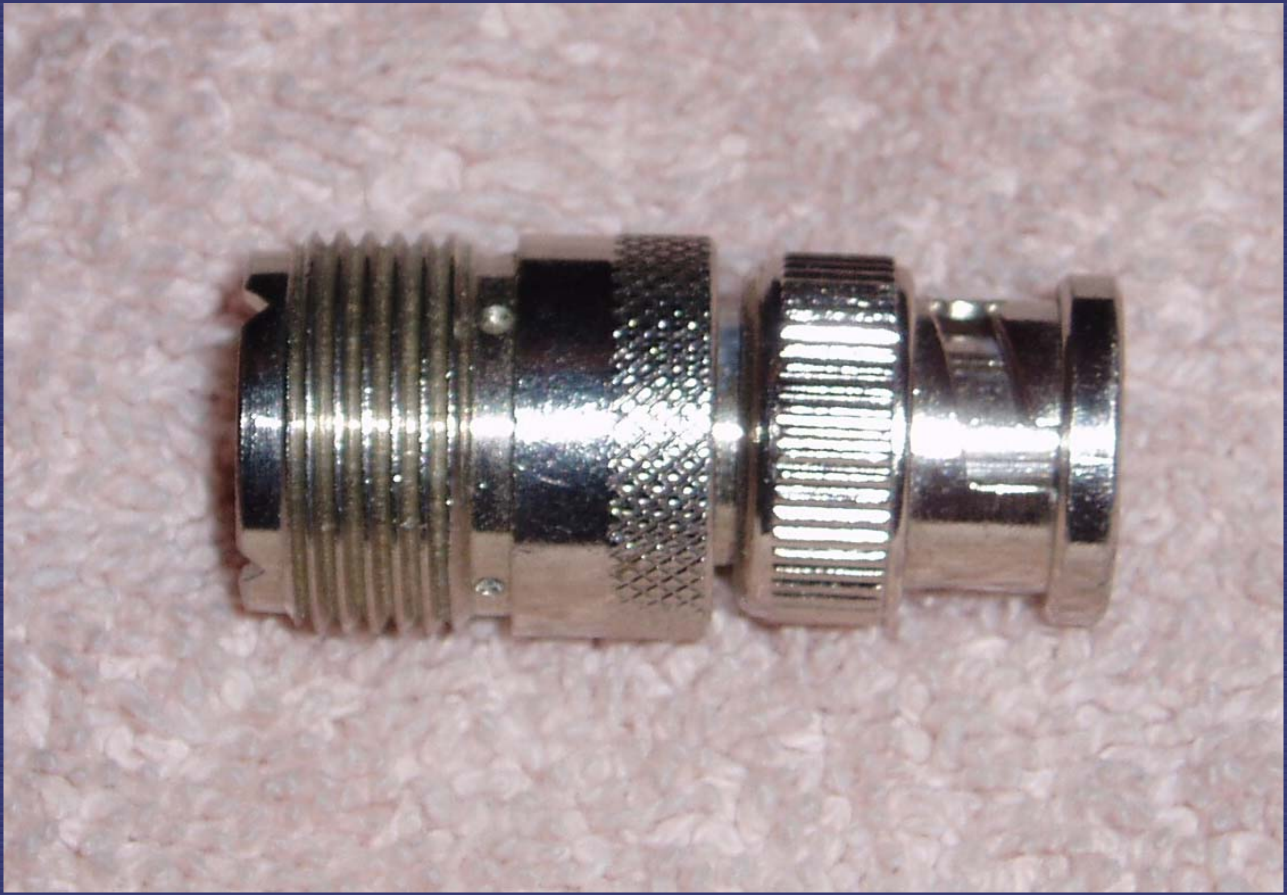
Larson PHW-150



Mag mount antenna with adapter

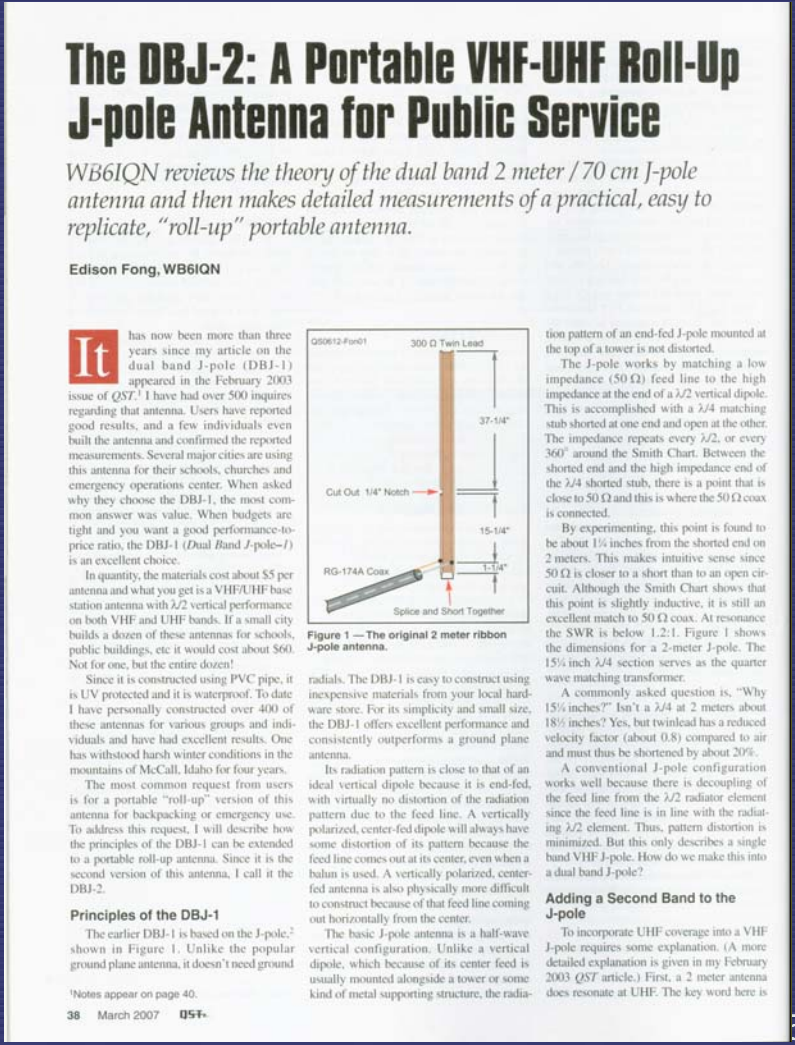


BNC to SO-239 adapter



Fold up J-Pole.

- See WB6IQN’s article in the March 2007 QST



The DBJ-2: A Portable VHF-UHF Roll-Up J-pole Antenna for Public Service

WB6IQN reviews the theory of the dual band 2 meter / 70 cm J-pole antenna and then makes detailed measurements of a practical, easy to replicate, “roll-up” portable antenna.

Edison Fong, WB6IQN

It has now been more than three years since my article on the dual band J-pole (DBJ-1) appeared in the February 2003 issue of *QST*.[1] I have had over 500 inquires regarding that antenna. Users have reported good results, and a few individuals even built the antenna and confirmed the reported measurements. Several major cities are using this antenna for their schools, churches and emergency operations center. When asked why they choose the DBJ-1, the most common answer was value. When budgets are tight and you want a good performance-to-price ratio, the DBJ-1 (*D*ual *B*and *J*-pole–*1*) is an excellent choice.

In quantity, the materials cost about $5 per antenna and what you get is a VHF/UHF base station antenna with $\lambda/2$ vertical performance on both VHF and UHF bands. If a small city builds a dozen of these antennas for schools, public buildings, etc it would cost about $60. Not for one, but the entire dozen!

Since it is constructed using PVC pipe, it is UV protected and it is waterproof. To date I have personally constructed over 400 of these antennas for various groups and individuals and have had excellent results. One has withstood harsh winter conditions in the mountains of McCall, Idaho for four years.

The most common request from users is for a portable “roll-up” version of this antenna for backpacking or emergency use. To address this request, I will describe how the principles of the DBJ-1 can be extended to a portable roll-up antenna. Since it is the second version of this antenna, I call it the DBJ-2.

Principles of the DBJ-1

The earlier DBJ-1 is based on the J-pole,[2] shown in Figure 1. Unlike the popular ground plane antenna, it doesn’t need ground radials. The DBJ-1 is easy to construct using inexpensive materials from your local hardware store. For its simplicity and small size, the DBJ-1 offers excellent performance and consistently outperforms a ground plane antenna.

Figure 1 — The original 2 meter ribbon J-pole antenna.

Its radiation pattern is close to that of an ideal vertical dipole because it is end-fed, with virtually no distortion of the radiation pattern due to the feed line. A vertically polarized, center-fed dipole will always have some distortion of its pattern because the feed line comes out at its center, even when a balun is used. A vertically polarized, center-fed antenna is also physically more difficult to construct because of that feed line coming out horizontally from the center.

The basic J-pole antenna is a half-wave vertical configuration. Unlike a vertical dipole, which because of its center feed is usually mounted alongside a tower or some kind of metal supporting structure, the radiation pattern of an end-fed J-pole mounted at the top of a tower is not distorted.

The J-pole works by matching a low impedance (50 Ω) feed line to the high impedance at the end of a $\lambda/2$ vertical dipole. This is accomplished with a $\lambda/4$ matching stub shorted at one end and open at the other. The impedance repeats every $\lambda/2$, or every 360° around the Smith Chart. Between the shorted end and the high impedance end of the $\lambda/4$ shorted stub, there is a point that is close to 50 Ω and this is where the 50 Ω coax is connected.

By experimenting, this point is found to be about 1¼ inches from the shorted end on 2 meters. This makes intuitive sense since 50 Ω is closer to a short than to an open circuit. Although the Smith Chart shows that this point is slightly inductive, it is still an excellent match to 50 Ω coax. At resonance the SWR is below 1.2:1. Figure 1 shows the dimensions for a 2-meter J-pole. The 15¼ inch $\lambda/4$ section serves as the quarter wave matching transformer.

A commonly asked question is, “Why 15¼ inches?” Isn’t a $\lambda/4$ at 2 meters about 18½ inches? Yes, but twinlead has a reduced velocity factor (about 0.8) compared to air and must thus be shortened by about 20%.

A conventional J-pole configuration works well because there is decoupling of the feed line from the $\lambda/2$ radiator element since the feed line is in line with the radiating $\lambda/2$ element. Thus, pattern distortion is minimized. But this only describes a single band VHF J-pole. How do we make this into a dual band J-pole?

Adding a Second Band to the J-pole

To incorporate UHF coverage into a VHF J-pole requires some explanation. (A more detailed explanation is given in my February 2003 *QST* article.) First, a 2 meter antenna does resonate at UHF. The key word here is

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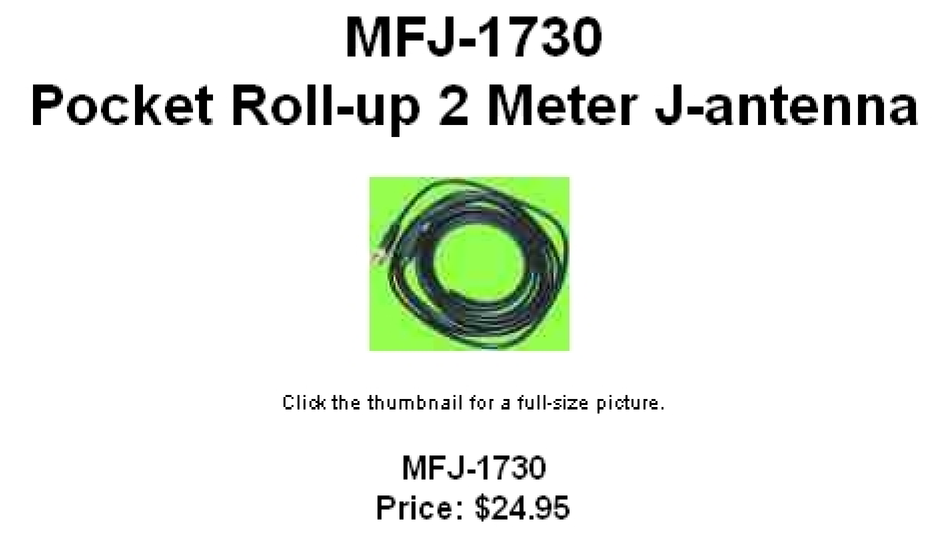
[1] Notes appear on page 40.

KB3KAI J-Pole

2M Antenna, 6 ft. RG-174, BNC

MFJ-1730 Roll-Up



MFJ-1730

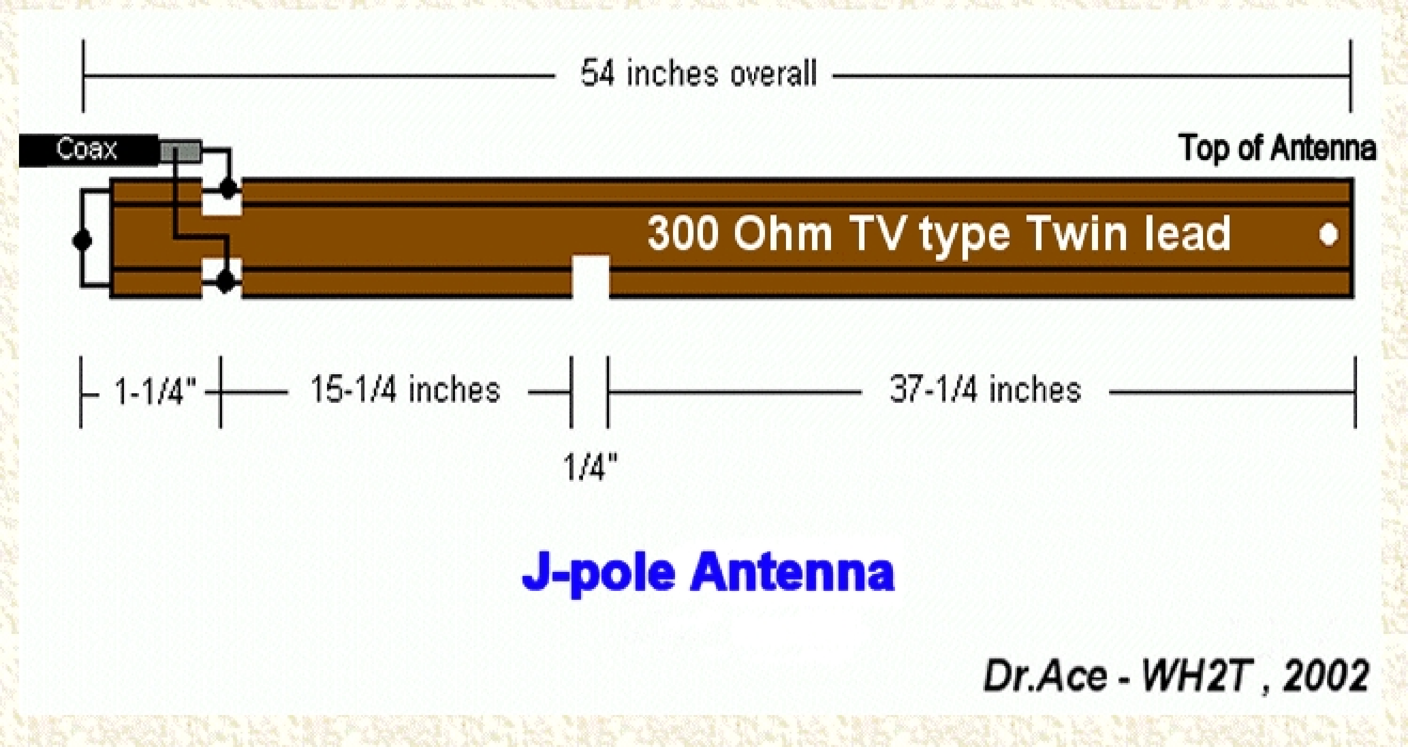
Pocket Roll-up 2 Meter J-antenna

Click the thumbnail for a full-size picture.

MFJ-1730

Price: $24.95

WH2T J-pole


54 inches overall
Coax
Top of Antenna
300 Ohm TV type Twin lead
1-1/4"
15-1/4 inches
37-1/4 inches
1/4"
J-pole Antenna
Dr.Ace - WH2T , 2002

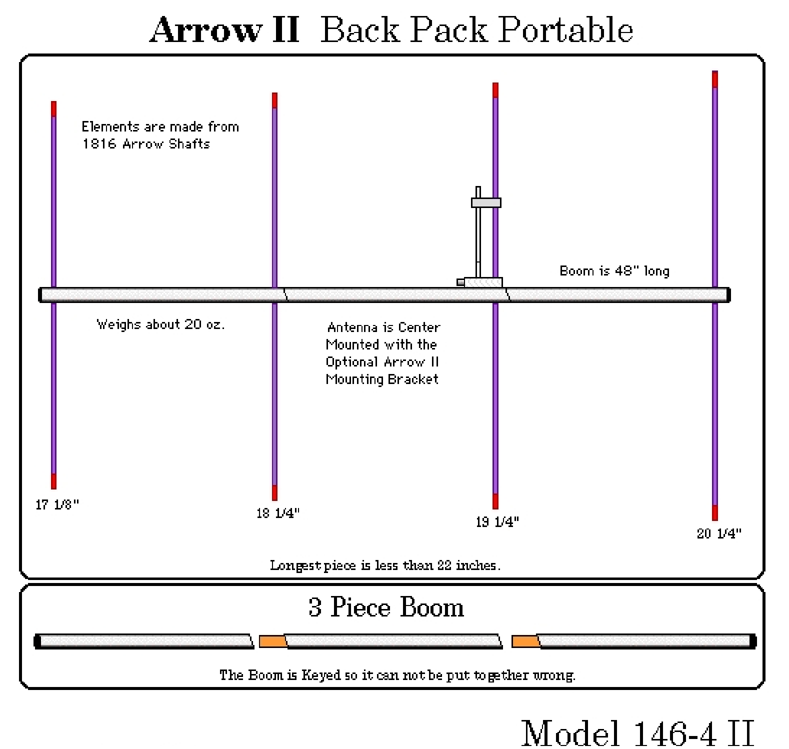
Ground planes for mag-mounts

- The more surface, the better
- Put the antenna in the center of the ground plane
- Use mag mounts on roof flashing, metal chimney caps, metal fences, garbage can lids, etc.

Tiger Tails

Provides a counterpoise for the antenna

Portable Yagis



Arrow II Back Pack Portable

Elements are made from 1816 Arrow Shafts

Boom is 48" long

Weighs about 20 oz.

Antenna is Center Mounted with the Optional Arrow II Mounting Bracket

Longest piece is less than 22 inches.

3 Piece Boom

The Boom is Keyed so it can not be put together wrong.

Model 146-4 II

Mobile Installations

- Antennas are critical
- Feedlines should be kept as short as possible
- Antennas should be mounted near the center of mass
- Antennas should be mounted as far away from other antennas as possible

Mobile Installations

- Fenders, hoods, and trunk lids should be bonded
- DC lines should be heavy gauge
- DC lines should be fused on both leads
- The radio should be mounted so the antenna connection is easily accessible

Portable Operations

- Use gain antennas if possible
- Get on high ground
- Get into a clear area if you can
- Elevate antennas if possible

HF Emergency operations

HF Advantages

- Excellent reliability
- Uses SSB and CW
- Short and medium distance operations with portable antennas

HF Disadvantages

- Size and weight of equipment
- Power requirements
- Antenna size
- Need for an antenna tuner and SWR bridge
- Power requirements
- QRM and QRN

NVIS

(Near Vertical Incidence Skywave)

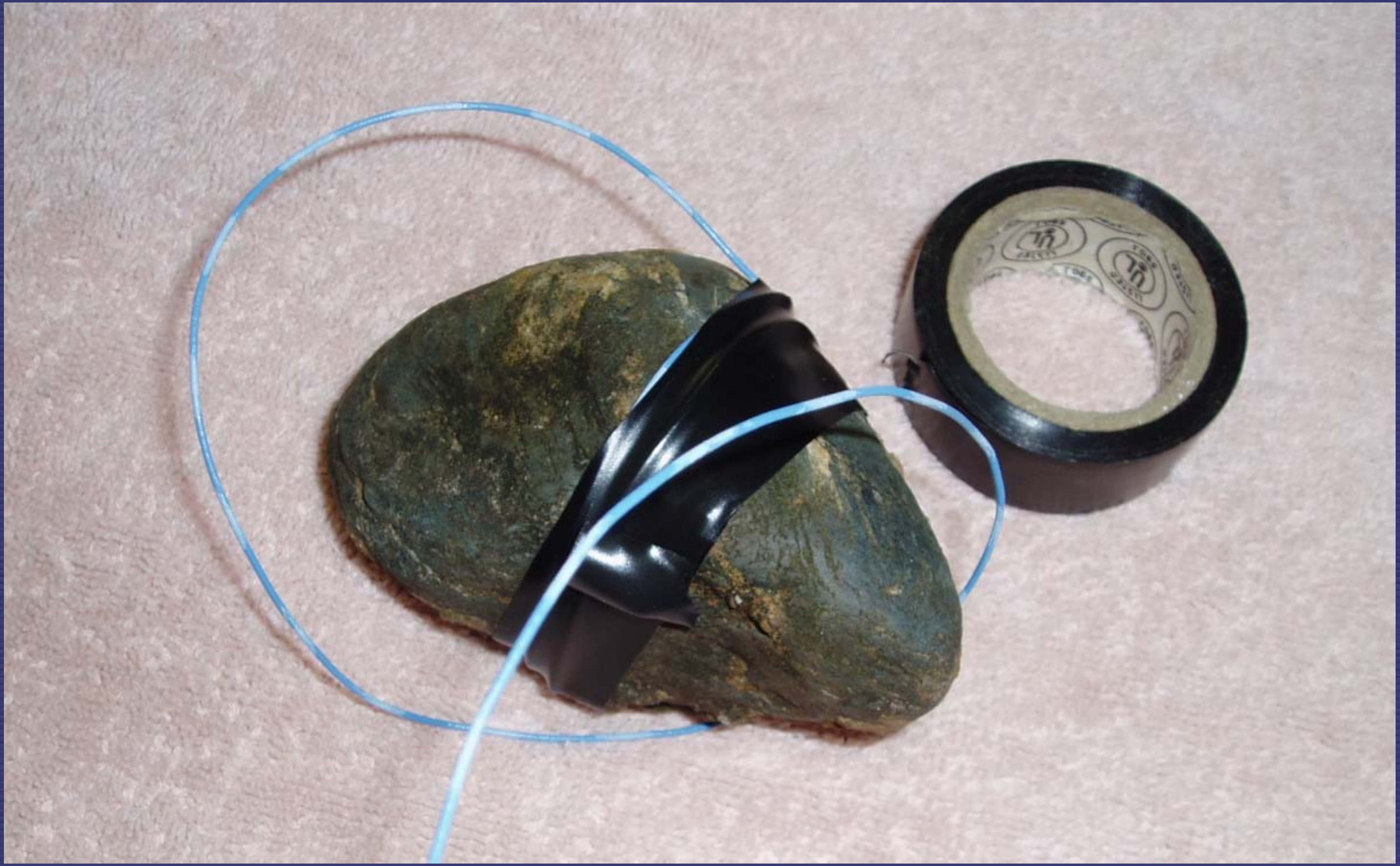
NVIS….

…most useful in mountainous areas where line of sight propagation at VHF or UHF frequencies is ineffective or when the communication distance is beyond ground wave (less than 50 miles) and less than sky-wave (300 to 1500 miles). (*Wikipedia*)

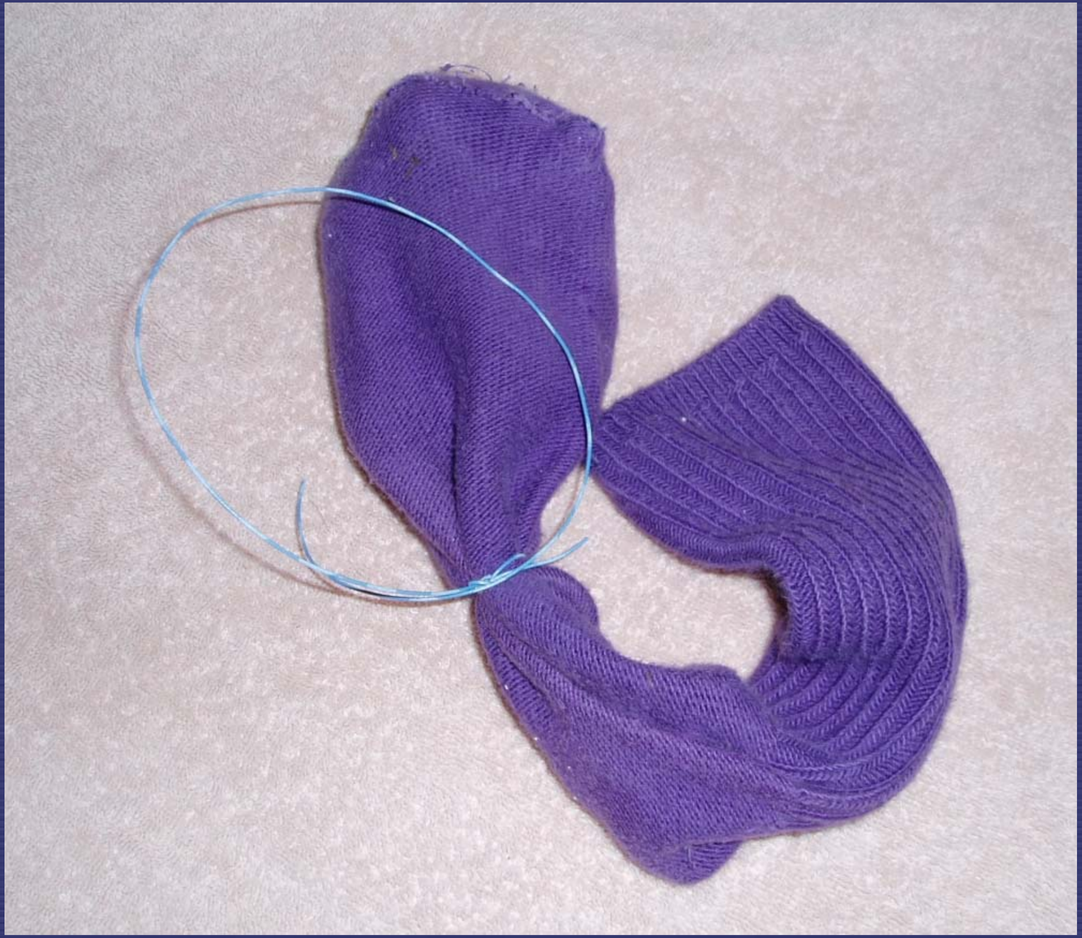
NVIS

- Random length or dipole wire antenna close to the ground
- Usually used with an antenna tuner
- Very high radiation angle
- Effective short range HF communications (usually 40 or 80 meter bands)

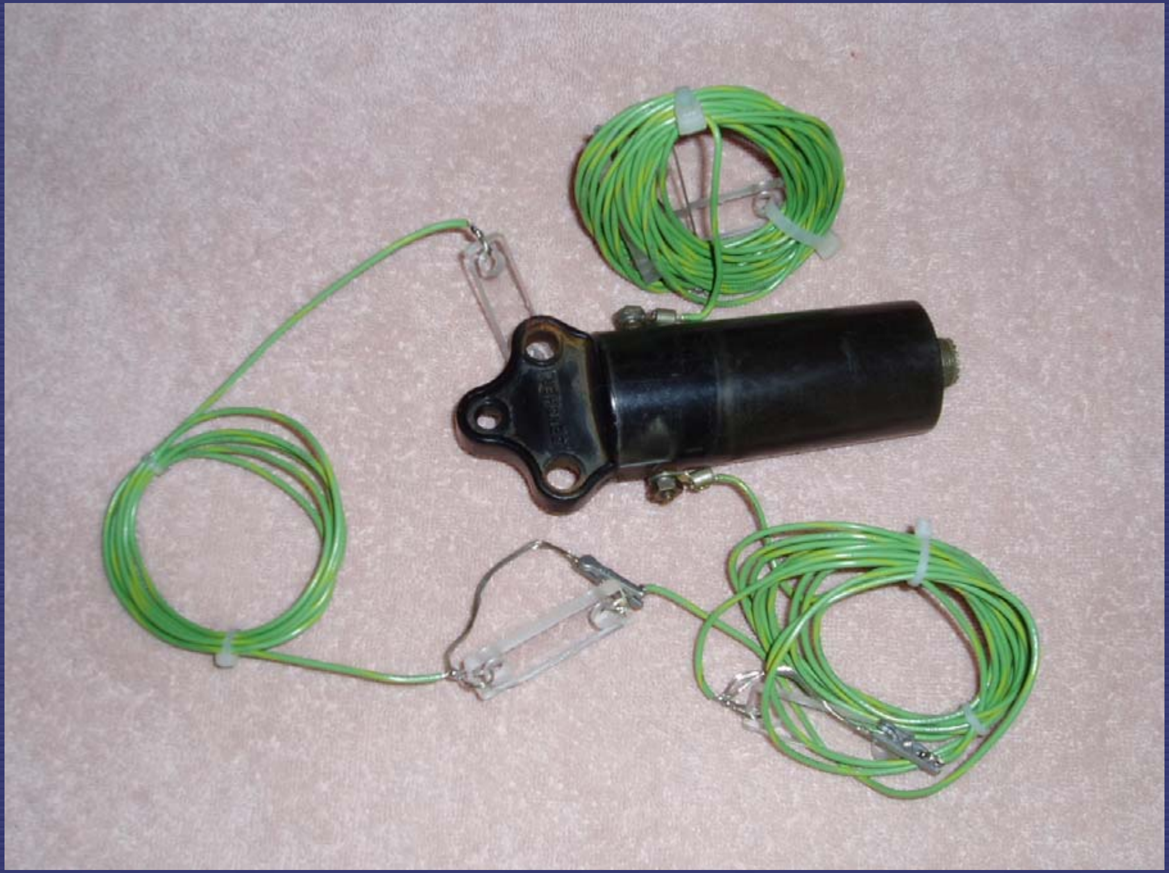
RTW
(Rock Terminated Wire)

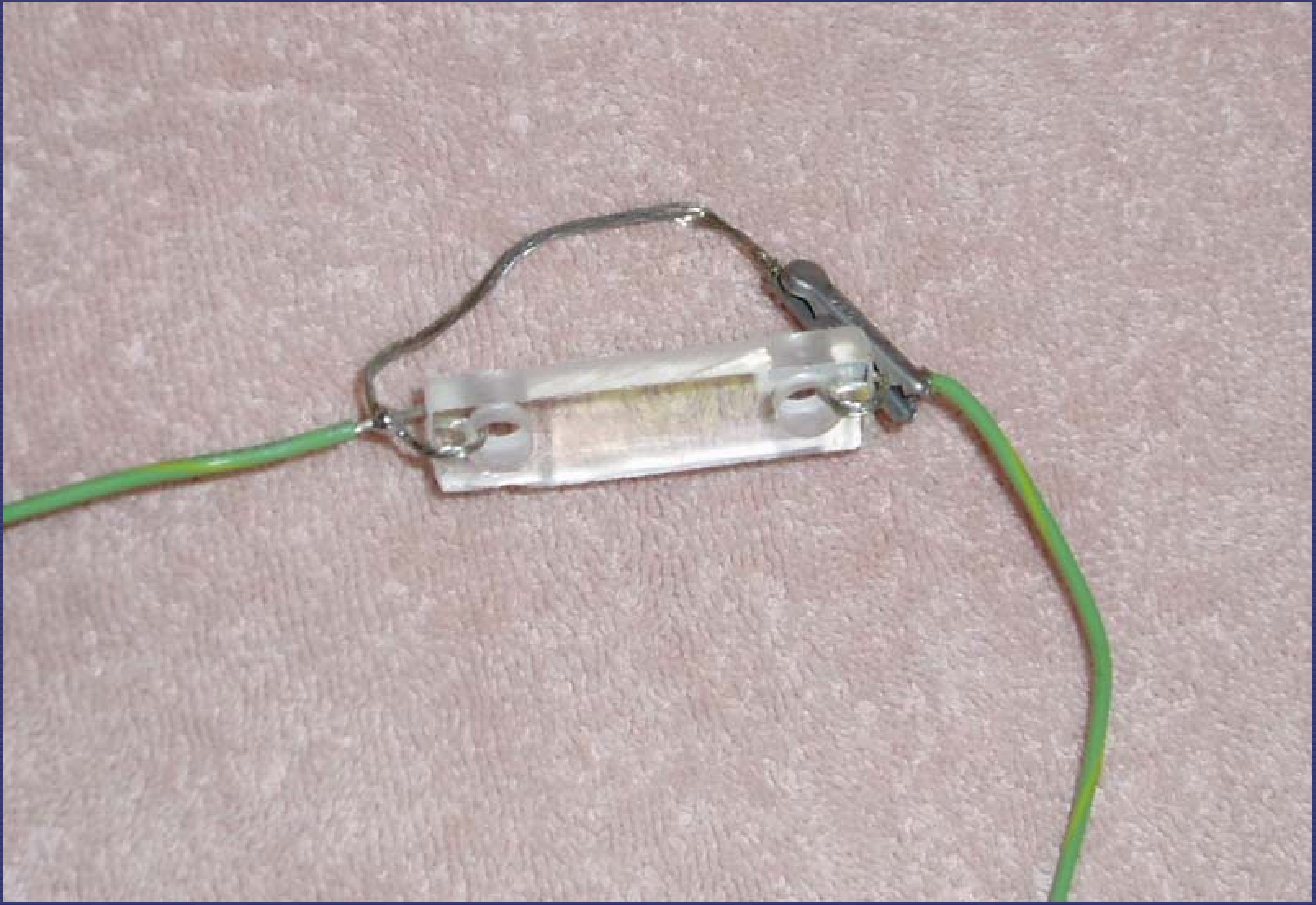


STW
(Sock Terminated Wire)



10/15/20 Meter Dipole/Inverted Vee





40/80 Meter Dipole/Inverted Vee

Other Factors

- Use of proper phonetics
- Do not use jargon
- Wind Shielding of microphone
- Tone of voice
- Voice pitch

And remember……

….a ***lot*** of people may be listening….

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Pacific Northwest VHF Society

- **www.pnwvhfs.org**
- Serving Washington, Oregon, Idaho and British Columbia
- At large members all over the U.S. and Canada
- Membership is not required to participate in the email group or to use the web page.
- Annual conference each fall

PNWVHFS Goals

- Foster the exchange of information
- Promote radio knowledge, fraternalism and individual operating efficiency
- Conduct society programs and activities to advance interest in VHF+ Amateur Radio activities in the Pacific Northwest

Thank you!

Lynn, N7CFO

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www.n7cfo.com

Bibliography
at

www.n7cfo.com.

Go to “Miscellaneous Stuff”